TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE WYOMING SOIL CONSERVATION SERVICE

Biology No. 304 January 1986

Subject: COMMON CARP*

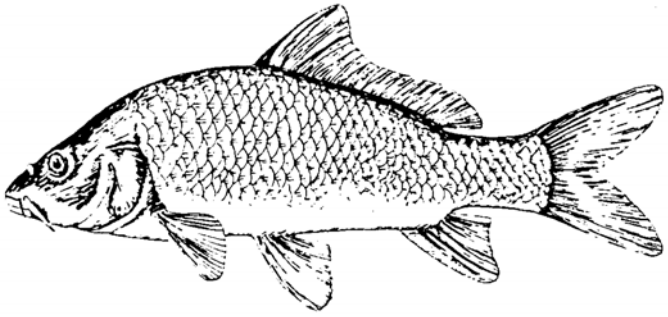
General

The common carp (Cyprinus carpio) is a native of Asia. It is now found on every continent except Antarctica and in all 48 contiguous states. The northern limit to carp distribution appears to be the 18°C isotherm. The common carp hybridizes in nature with the goldfish.

Age, Growth, and Food

Fast growing males may mature at age I, but most mature at ages II to IV in temperature climates. Females generally mature between ages III and V. The maximum weight reported for an adult was 37.4 kg in South Africa and 42.1 kg in North America.

The adults are opportunistic feeders which are able to utilize any available food source. Fry initially feed on zooplankton, but feed on phytoplankton when zooplankton density is low. As the young fish grow, they feed on littoral fauna and later on bottom fauna, taking in worms and larvae of aquatic insects as well as vegetable food, such as seeds, algae, and detritus.



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*Information taken from Ecoregion M3113 Handbook and Habitat Suitability Index Models, Wildlife Species Narratives (literature searches), U.S. Fish and Wildlife Service, various dates between 1978-1984.

Reproduction

The carp generally spawns in spring, but in warmer, southern climates, spawning can occur from March to June and in cooler, northern climates, from May to June. Females with recently spent ovaries have been observed from March to October, and ripe males have been observed during most of the summer months in the temperate zone. This indicates that the species may spawn over a prolonged period of time in warmer environments.

In reservoirs, rising water levels may provide access to terrestrial vegetation, which is good substrate for spawning. In Lake Oahe, peak spawning occurred during the 4 or 5 days when water levels fluctuated only slightly (<7 cm) or increased rapidly following a level period. Fluctuating reservoir waters may be detrimental to carp populations.

Adults congregate and deposit their adhesive eggs on aquatic or submerged terrestrial vegetation or any other object the eggs will adhere to. Spawning over areas of dense vegetation will increase reproductive success.

Specific Habitat Requirements

In both riverine and lacustrine habitats, carp prefer enriched, relatively shallow, warm, sluggish, and well-vegetated waters with a mud or silt substrate. Adults spend summer and early autumn in shallow areas of dense vegetation, and, as temperatures drop, the fish move into deeper waters for the winter.

The species prefers areas of slow current. In the Missouri River, common carp occurred in pools and chutes (≤60 cm/sec) and in main channel borders (60-120 cm/sec), but were most abundant in marshes and backwaters (≤20 cm/sec). Deep pools with abundant cover, including logs, brush, and other objects, provide feeding and resting areas in swift rivers. Although occasionally found in high gradient streams, the species is more common in low to moderate gradient streams. In high gradient streams, carp occur in warm backwaters and in organically polluted sections.

Carp also thrive in reservoirs, lakes, bayous, estuaries, farm ponds, and sewage lagoons. In lacustrine habitats, adults are usually found in association with abundant vegetation. Waters with a diversity of both shallow and deep areas represent optimum habitat.

Reservoir storage ratio (SR) (ratio of mean reservoir water volume to annual discharge volume) may also affect habitat suitability. It has been reported that standing crops peak at storage ratios less than 0.4 and at about 1.5 and decline above 2.0.

Common carp are extremely tolerant of turbidity as long as food production is not limiting. The species can tolerate turbidities far above those usually found in nature. Feeding and spawning activities over silty bottoms increase turbidity. Turbidity levels >200 JTU and Secchi dis visibilities <8 cm are common at spawning sites.

Optimum growth of freshwater fish in general occurs at pH levels of 6.8-7.5. Growth is reduced at a pH <6.0, probably due to a reduced food supply. A pH of <5.0 is reported as harmful to carp. The pH levels of the Bear River Migratory waterfowl refuge, an excellent carp habitat, range around 8.1. Carp are common in New Mexico reservoirs having a pH in the 8.5 to 8.7 range, but a pH of 10.5 is lethal. Fluctuating pH values and the presence of toxic substances will affect the pH tolerances of the species, but are not considered here.

Adult. High production is strongly correlated with warm, midsummer (July and August) water temperatures, as well as the number of days with temperatures >20°C. In Lake Powell, large numbers were collected at temperatures from 18°-27°C. One researcher observed that at the Bear River marshes when the temperature exceeded 26°C in the flats, carp moved into deeper, cooler water. A range of 20°-28°C is optimum for growth under laboratory conditions, and temperatures <13°C and ≥30°C cause the growth rate to decrease. The upper lethal temperature for adults is ≥34.5°C, and feeding ceases at 5°C.

Adults are very tolerant of low dissolved oxygen (DO) levels, condition common in warm, fertile waters. Adults will also feed in the oxygen-depleted hypolimnion (<2 mg/l DO). Adults can gulp surface air when the DO is ≤0.5 mg/l. Respiration is elevated at 3-5 mg/l DO (13°-23°C). The DO should remain at least 6-7 mg/l for good growth.

Common carp may occupy brackish or saline waters, but production is low in these areas. In Israel, the species is grown in ponds at salinities of 0.1-5.0 ppt. Yields decrease at 2.0-3.0 ppt, although food production may also be limiting at this level. A salinity level of 7.2 ppt is lethal after 36 days in lab aquaria. Although the species is tolerant of saline conditions, a rapid change from fresh to salt water can be lethal to carp.

Embryo. Preferred spawning areas are over aquatic or inundated terrestrial vegetation at depths of <0.5 m, but spawning has also been observed over vegetation in water up to 1.8 m deep. Moderately warm water temperatures are a primary environmental stimulus for spawning, and spawning temperatures are in the range of 18° to 23°C. The species generally will not spawn in waters with an average summer temperature <18°C; spawning activity decreases at temperatures >26°C and stops at 28°C. Temperatures <11°C can increase embryo mortality.

Eggs are tolerant of fluctuating oxygen levels, and some may survive short exposures to DO levels as low as 1.2 mg/l (25°C). Percentage hatching increases with increasing DO content. At 3 mg/l DO, 40 percent of the embryos hatched; at 6 mg/l, 65 percent hatched; and at 9 mg/l, 92 percent hatched.

Fry. After hatching, the fry remain in shallow (<2 m), warm, fertile, sluggish waters for 2 to 8 weeks. Vegetation and turbidity provide cover and protection from predators as well as a good environment for

food production.

Larvae are more tolerant of temperature extremes-than embryos. The low temperature threshold for larvae is ≤7°C. Larval common carp can survive and continue to feed at 36°C, but most will die at 38°C. Preferred temperature for fry was reported to be 27°C, and the optimium growth was at 30°C.

Lower lethal oxygen levels for fry in the laboratory are <1.6 mg/l at 21°-22°C. Larvae die at salinities greater than 4 ppt, but growth slows before this level.

Juvenile. Juveniles are most common in the same habitat as the fry. Optimum growth of juveniles occurs from 28°-30°C. Temperature preferences of juveniles in the laboratory and in thermal effluents have been reported to be between 27°C and 33.5°C. Daily food consumption was greatest at 23°-27°C. Temperatures 38°C are lethal for juveniles.

The lower lethal oxygen level for juveniles is <1.0 mg/l (<20°C). The growth rate of juveniles begins to decrease at approximately 2.1 mg/l at 20°-23°C. Optimal DO levels are assumed to be ≥6 mg/l, as with adults. Salinities greater than 6 ppt were reported to be lethal to juveniles.